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54 **Cotyloidal reconstruction module**

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This module comprises three elements, namely:

- a flat ring equipped (3) on one hand with, on its lower part, with a plate (8) extending from its outer edge, this plate (8) being curved to form a hook and on the other, in its upper part with two fastening plates (9, 10) projecting from it outer edge and tipped with respect to its plane on the same side as the curved plate (8), the curved plate (8) being formed to allow it to be connected in the hole (11) in the iliac bone (12) and the two plates (9, 10) mentioned above formed to allow them to be fixed, using appropriate means, on the iliac wing (13) in such a way that the opening of the ring coincides with the opening of the cotyloidal cavity (14), the ring itself comprising the means for fastening it to the bone;

- a cup assembly (4) comprising one part (25) with a generally essentially hemispherical shape, of which the largest outer diameter is at least less than the inner diameter of the ring (3) and of which the opening extends with an annular lip (26) curved at 90 degrees to the outside, the part (25) of the generally essentially hemispherical shape being intended to connect in the cotyloidal cavity (14) across from the ring (3), until the lip (26) of the cup assembly (4) covers the face (3a) of the ring (3) turned toward the outside at which it is intended to be fastened;

- an insert (5) with the general form of a hemispherical cap intended to connect in the cup assembly cavity (4).

FR 2 660 546 – A1

COTYLOIDAL RECONSTRUCTION MODULE

The object of the present invention is a cotyloidal reconstruction module.

It is now common to proceed with implantation of a prosthesis in the case of deterioration of the head of the femur of the cotyloidal cavity on the interior of which said head is mounted with articulation. A prosthesis comprises an implant of a synthetic material generally fastened by sealing on the inside of the cavity after preparation of same, the implant having a generally hemispherical shape, of which the cavity is used for attachment of a head with a complementary spherical shape, which is fasted at the upper end of a rod engaged in the femur and that is able to pivot with respect to the cotyloidal implant to make possible different movements of the leg, notably in walking.

Taking into account the large number of prostheses installed, sometimes over a long period of time it is not rare to attend to a possible unsealing of the implant, possibly accompanied by a protrusion of same. While a simple cotyloidal unsealing can repaired by sealing an implant of a larger size, on the other hand, in the case of a complex cotyloidal unsealing, which involves a significant destruction of the cotyloidal cavity involving the base and the head of the cotyle with a thinning or even disappearance of the bony supports. The sealing of a new implant is of very mediocre effectiveness due to the absence of adequate bony supports.

Thus it is necessary to attempt to reconstruct the original anatomy by proceeding with bone implants, on which the implant can be mounted in which the head of the prosthesis is articulated. Connecting an implant support element between the implant and the bone grafts in the form of a ring or a screen is known. Still, the supports known at this time are difficult to fasten and have very mediocre effectiveness.

To remedy these disadvantages, the applicants have filed a French patent request no. 88.10 032 concerning a cotyloidal reconstruction module that comprises a central metal part in the form of a hemispherical cup assembly, of which the external face is intended to come into contact with the cotyloidal cavity and of which the interior face is equipped with means for fastening an insert that is used for the articulation of the head to the prosthesis, this cup assembly being equipped on one part of its lower end with a hook that, turned toward the interior, is intended to be connected in the hole of the iliac bone,

and on the other part of its upper part with two plates, of which the first is tipped toward the inside and toward the front with respect to the opening plane of the cup assembly and of which the second is tipped toward the interior and toward the back with respect to the opening plane of the cup assembly, these plates being equipped with means for fastening on the iliac wing.

This module, which is used with satisfaction, nevertheless presents the disadvantages of having an inconvenient construction because of its complex structure and above all because it does not allow the physician to easily control the adequate thickness of the bony implants placed in the base of the cotyloidal cavity and its correct positioning in order to ensure good contact between those of the cup assembly when the module if fastened in final form.

In fact, the significance of these areas of bone thinning can not always be foreseen before the surgery, it being possible for certain areas of bone thinning to be considerable and make the reconstruction very difficult, requiring the physician to proceed with a trial and error method to determine the best position for the implants. With the module described above, the implants must be positioned in a definitive manner so that the cup-shaped part does not cover them and so that the module will not be fastened to the bone. In fact, it has not proven to be possible, nor desirable, to remove that module several times.

In addition, the cup-shaped part must exert a certain amount of pressure on the implants to allow a sort of "molding" of same between it and the base of the cavity. Before the final installation, it is difficult to forecast the position of the implants in the base of the cavity so that the pressure the part in the shape of a cup will exercise on it when it is mounted will be correct, the tightening of the fastening screws involve a slight displacement of the module assembly can vary as a function of the contract of the part in the shape of a cup on the implants. Because of this displacement, which the physician must take into account, it is not certain until after installation that the cup-shaped part will exert an adequate and uniform on the implants.

The present invention intends to remedy these disadvantages by furnishing a cotyloidal reconstruction module that will be easy to manufacture and able to make it possible to easily control the positioning of the bony implants as a function of the final position of the cup assembly engaged in the

cavity.

For this purpose, the module that this concerns comprises three elements, namely:

- a flat ring equipped on one hand with, on its lower part, with a plate extending from its outer edge, this plate being curved to form a hook and on the other, in its upper part with two fastening plates projecting from it outer edge and tipped with respect to its plane on the same side as the curved plate, the curved plate being formed to allow it to be connected in the hole in the iliac bone and two plates mentioned above formed to allow them to be fixed, using appropriate means, on the iliac wing in such a way that the opening of the ring coincides with the opening of the cotyloidal cavity, the ring itself comprising the means for fastening it to the bone;

- a cup assembly comprising one part with a generally essentially hemispherical shape, of which the largest outer diameter is at least less than the inner diameter of the ring and of which the opening extends with an annular lip curved at 90 degrees to the outside, the part of the generally essentially hemispherical shape being intended to connect in the cotyloidal cavity across from the ring, until the lip of the cup assembly covers the face of the ring turned toward the outside at which it is intended to be fastened;

- an insert with the general form of a hemispherical cap intended to connect in the cup assembly cavity.

After connection of the curved plate in the hole of the iliac bone, the ring is fastened to the bone in a temporary manner. If the positioning of the ring appears satisfactory, the plates are fasted in a final manner to the iliac bone. The implants are then arranged in the base of the cotyloidal cavity in the zones of bone thinning and the cup assembly is connected across from the ring. The positioning of its annular lip with respect to the outer face of the ring, which is in its final position and which is used to locate the definitive position of the cup assembly when it is attached to it, makes it possible for the physician to easily determine if the thickness and the positioning of the implants is correct. On the negative side, the plane of the annular lip is not parallel to the plane of the ring. It is then easy to withdraw the cup assembly to modify the arrangement of the ring. On the positive side, the plane of the annular lip is parallel to the plane of the ring. The physician could plan to arrange the implants in such a way that, when the cup

assembly is simply in contact with it, a space remains between the walls across from the annular lip and the ring.

At the time when the ring is fastened, the cup assembly will be displaced axially to bring these walls in contact with each other, this displacement involving a uniform pressure on the implants. In practice, the physician will be able to determine the space corresponding to the ideal pressure to be determined.

Advantageously, the ring comprises projections projecting from its inner edge toward the inside and the cup assembly comprises longitudinal recesses with transverse cross section with a shape corresponding to the shape of the projections, each of these recesses being intended to engage on a projection. Thus, any rotation movement of the cup assembly with respect to the ring is prevented.

Preferably, the ring and its plates, as well as the cup assembly, are made of titanium or titanium alloy, the insert being of polyethylene. The outer surface of the outer essentially hemispherical part of the cup assembly is covered with calcium hydroxyapatite to make up the physical-chemical bonds with the boney implants without fibrous insertion.

According to a simple embodiment of the invention, the means for fastening the ring to the bone and the means for fastening the cup assembly to the ring are made up of screws, the ring and the annular lip of the cup assembly comprising holes that match each other when the cup assembly is connected in the ring.

In any case, the invention will be better understood from the description that follows, with reference to the schematic drawing attached that represents, by way of a non-limiting example, a preferred embodiment of the module according to the invention.

Figures 1 and 2 are perspective views of two of its constituent elements; and

Figure 3 is a view in installed position in longitudinal cross section along axis III-III of figure 2.

Figure 3 shows a cotyloidal reconstruction module 2 that is made up of a ring 3 and a cup assembly 4 of titanium, as well as an insert 5 of polyethylene.

Figures 1 and 2 represent, most specifically, the ring 3 and the cup assembly 4.

The ring 3 has a flat shape and is equipped on one hand, at its lower part, with a plate 8 curved to form a hook and on the other, at its upper part, with two fastening plates 9 and 10 tilted with respect to its plane on the same side as the curved plate 8. As Figure 1 shows, the curved plate 8 is formed so that it can be connected in the hole 11 of the iliac bone 12 and the plates 9 and 10 are formed so that they can be fastened on the iliac wing 13 in such a way that the opening of ring 3 coincides with the opening of the cotyloidal cavity 14.

If the ring 3 is considered in a vertical plane, the curved plate 8 is tilted at an angle on the order of 30° toward the inside, the plate 9 called "anterior-superior" is tilted, with respect to this plane, towards the inside and toward the front along an angle of around 30° toward the inside and 40° toward the front. The plate 10 called "posterior-superior" is tilted toward the inside and toward the rear according to an angle of around 90° toward the inside and 20° toward the rear.

Taking into account the specific angles of the plates 8, 9 and 10, 11 it is necessary to provide a module for implanting on the right and a module for implanting on the left. The angles that have been indicated above are able to be modified slightly by the physician at the time the prosthesis is implanted to allow perfect contact between the plates 9 and 10 and the iliac wing 13, the fastening of the plates 8, 9 and 10 being carried out in a simple manner and advantageously by screws across the holes arranged at the time of construction, respectively 20, 21 and 22.

The ring 3 also comprises four projections 23 and projecting toward the inside and five fastening holes 24.

The cup assembly comprises a part 25 with a generally essentially hemispherical shape of which the largest outer diameter is at least less than the diameter of the opening of the ring 3 and of which the outer face is covered with calcium hydroxyapatite. the opening of the cup assembly 4 extends by a lip 26 in annular form curved 90 degrees toward the outside. In addition, the cup assembly 4 comprises longitudinal recesses 27, of which the transverse cross section has a shape corresponding to the shape of the projections 23 and holes 28 and 29. The holes 28 are arranged in such a way that they can be superimposed over the holes 24 of the ring.

Besides that, with reference to the assembly of the figures it can be seen that the cup assembly 4

comprises seats 35 arranged along a regular angular distribution, for example eight seats arranged at 45 degrees with respect to each other and an annular neck 36 arranged in its internal face. In addition, the insert 5 comprises a ring 37 of titanium corresponding to the neck 36, positioning ribs 38 of which the number and the distribution are multiples of those of the seats 35 of the cup assembly 4, for example four ribs arranged at 90 degrees with respect to each other and able to engage with certain of the seats 35. An anti-luxation lip 39 is provided in the insert 5.

In practice, once positioned, as is shown in Figure 1, the ring 3 is fastened to the bone 12 in a temporary manner by screws that engage in its holes 24. If the positioning of the ring is correct, the plates 8, 9 and 10 are fastened in a final manner using the screws engaged in their respective holes 20, 21 and 22.

After placement the bony implants in the base of the cavity 14, the part 25 of the cup assembly 4 is connected, as shown in Figure 3, across from the ring 8 until it comes in contact with the implants. Each of the recesses 27 engages around a projection 23, which makes it possible to immobilize the cup assembly in rotation with respect to the ring 3. The positioning of the lip 26 with respect to the upper face 3a or the ring 3 makes it possible for the physician to determine whether the thickness and the positioning of the implants is correct, the face 3a being used to locate the definitive position of the cup assembly 4, the face 3a and the face 26a across from the lip 26 being intended to come in contact with each other at the time of final fastening of the cup assembly 4 to the ring 3. In order to carry out this fastening, the screws engaged in the holes 24 are taken out, the cup assembly 4 is put in place and these same screws are connected across the holes 28, then the holes 24, and tightened. Supplementary fastening screws are put in place in holes 29.

The insert 5 is then connected in cup assembly 4, the ring 37 locking into the neck 36. The ribs 38 immobilize the insert 5 in rotation. Thanks to the greater number of seats 35 and their arrangement with respect to ribs 38, it is possible to control the orientation of the anti-luxation lip 39 according to the requirements by varying the relative position of the insert 5 with respect to the cup assembly 4 to prevent any escape of the head of the femoral component from the cavity 40 of the insert 5.

CLAIMS

1 - Cotyloidal reconstruction module, characterized in that it comprises three elements, namely:

- a flat ring equipped (3) on one hand with, on its lower part, with a plate (8) extending from its outer edge, this plate (8) being curved to form a hook and on the other, in its upper part with two fastening plates (9, 10) projecting from it outer edge and tipped with respect to its plane on the same side as the curved plate (8), the curved plate (8) being formed to allow it to be connected in the hole (11) in the iliac bone (12) and the two plates (9, 10) mentioned above formed to allow them to be fixed, using appropriate means, on the iliac wing (13) in such a way that the opening of the ring coincides with the opening of the cotyloidal cavity (14), the ring itself comprising the means for fastening it to the bone;

- a cup assembly (4) comprising one part (25) with a generally essentially hemispherical shape, of which the largest outer diameter is at least less than the inner diameter of the ring (3) and of which the opening extends with an annular lip (26) curved at 90 degrees to the outside, the part (25) of the generally essentially hemispherical shape being intended to connect in the cotyloidal cavity (14) across from the ring (3), until the lip (26) of the cup assembly (4) covers the face (3a) of the ring (3) turned toward the outside at which it is intended to be fastened;

- an insert (5) with the general form of a hemispherical cap intended to connect in the cup assembly cavity (4).

2 - Module according to Claim 1, characterized in that the ring (3) comprises projections (23) projecting from its inner edge toward the inside and the cup assembly (4) comprises longitudinal recesses (27) with transverse cross section with a shape corresponding to the shape of the projections (23), each of these recesses (27) intended to be engaged on a projection (23).

3 - Module according to Claim 1 or 2, characterized in that the ring (3) and its plates (8, 9, 10), as well as the cup assembly (4), are made of titanium or titanium alloy, the insert (5) being of polyethylene.

4 - Module according to one of Claims 1 to 3, characterized in that the outer surface of the essentially hemispherical part (25) of the cup assembly (4) is covered with calcium hydroxyapatite.

5. Module according to one of Claims 1 to 4, characterized in that the means for fastening the ring (3) to the bone (12) and the means for fastening the cup assembly (4) to the ring (3) are made up of screws, the ring (3) and the annular lip (26) of the cup assembly (4) comprising holes (24, 28) which are superimposed when the cup assembly (4) is connected in the ring (3).

6. Module according to one of Claims 1 to 5, characterized in that the plate (9) is tilted toward the inside and toward the front with respect to the plane of the ring (8) and the plate (10) is tilted toward the inside and toward the rear with respect to the same plane.

7. Module according to one of Claims 1 to 6, characterized in that the means for fastening the insert (5) in the cup assembly (4) of the module (2) are made up of means (36, 37) for locking, the cup assembly (4) also comprising several seats (35) arranged according to a regular annular distribution while the insert (5) comprises positioning ribs (38) complementary to the said seats (35) of which the number and the distribution are multiples of those of the seats (35) of the cup assembly (4).

[see original for Figures 1 – 3]